

Initiation Date:

30 July 2016

Participant(s):

N3FB, WB4GCS

Initial Symptoms:

One filter failed at Field Day, was opened and obviously damaged. It was decided to test all.

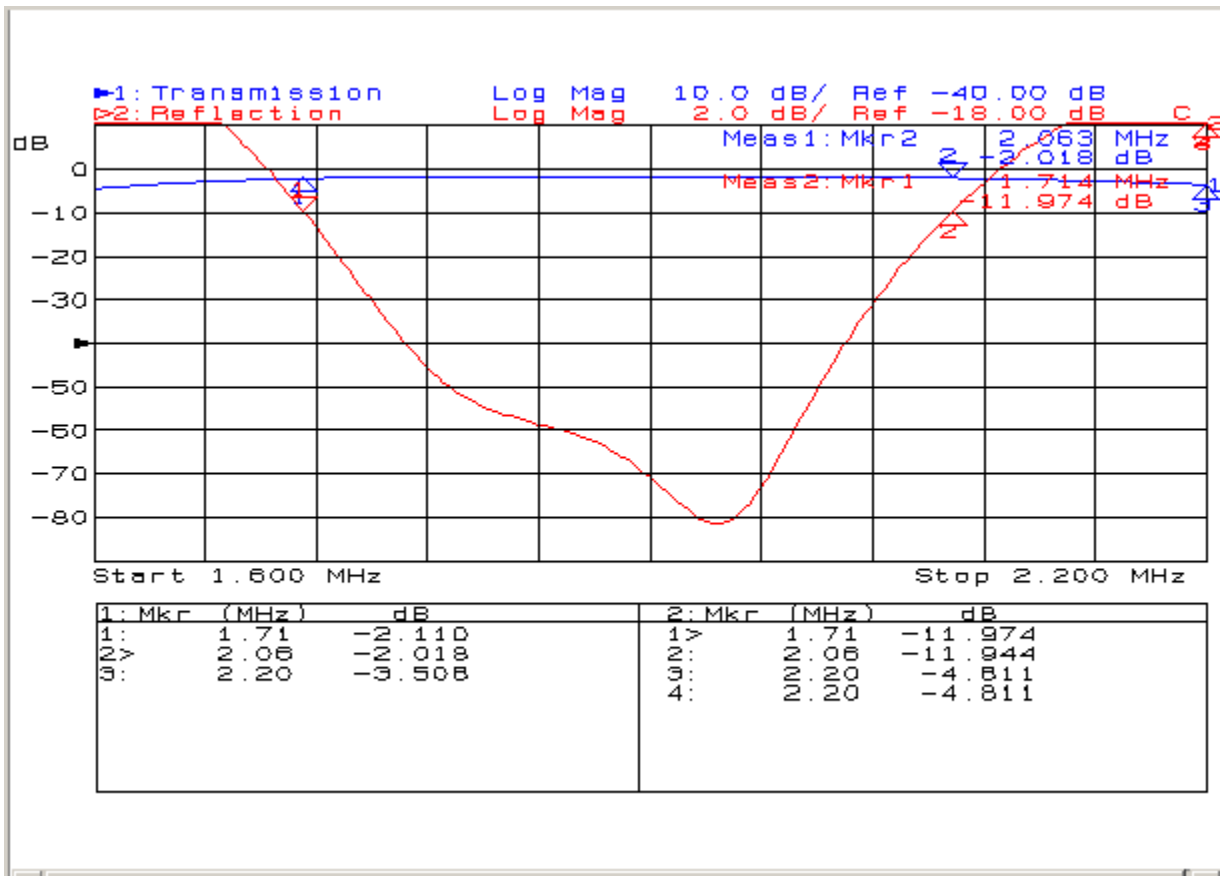
Actions:

Label each filter for ID.

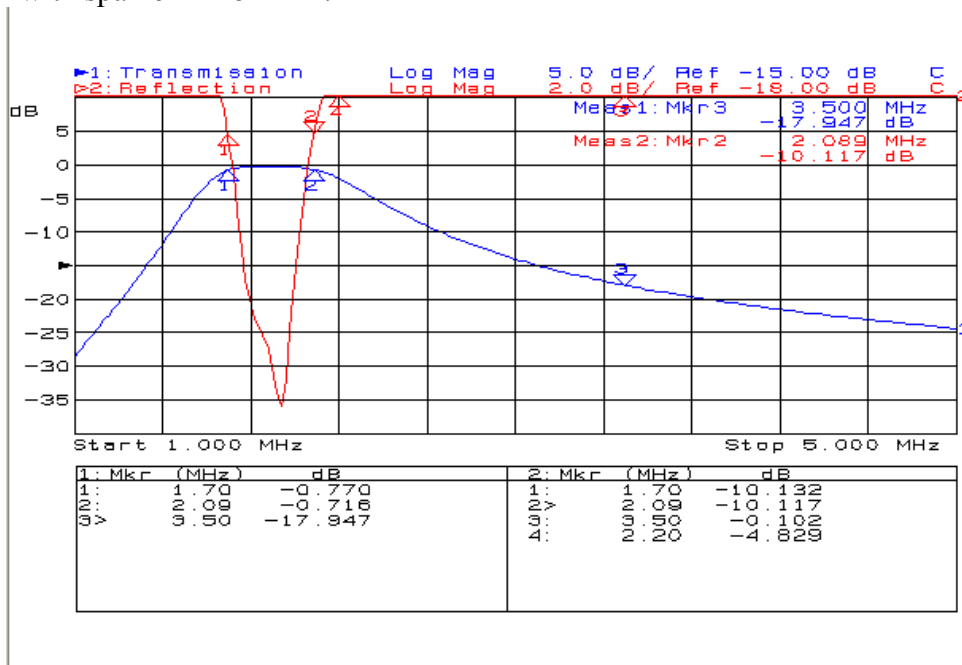
Calibrate analyzer.

Observations:

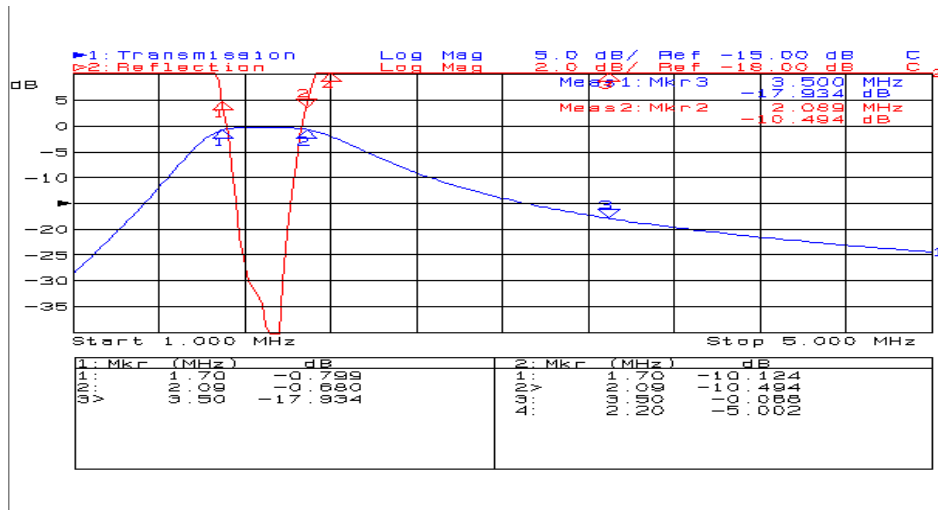
Measure N3SH 160-1



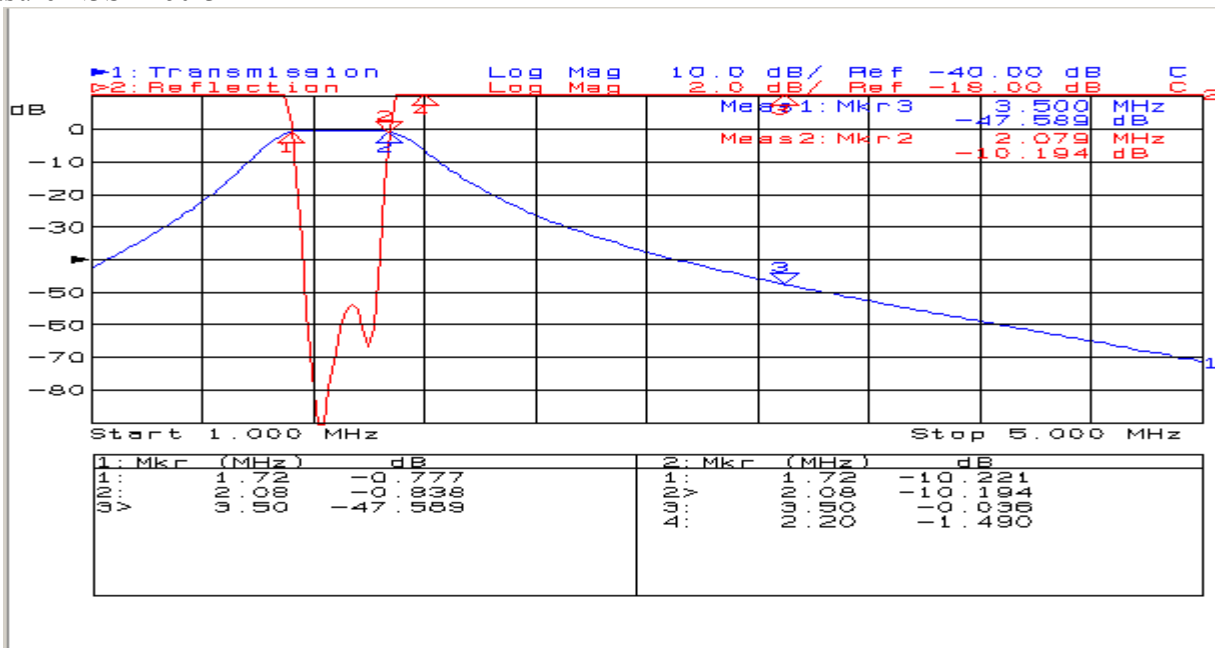
Measure again with span of 1 – 5 MHz.



Measure WA3SH 160



Measure N3SH160-3



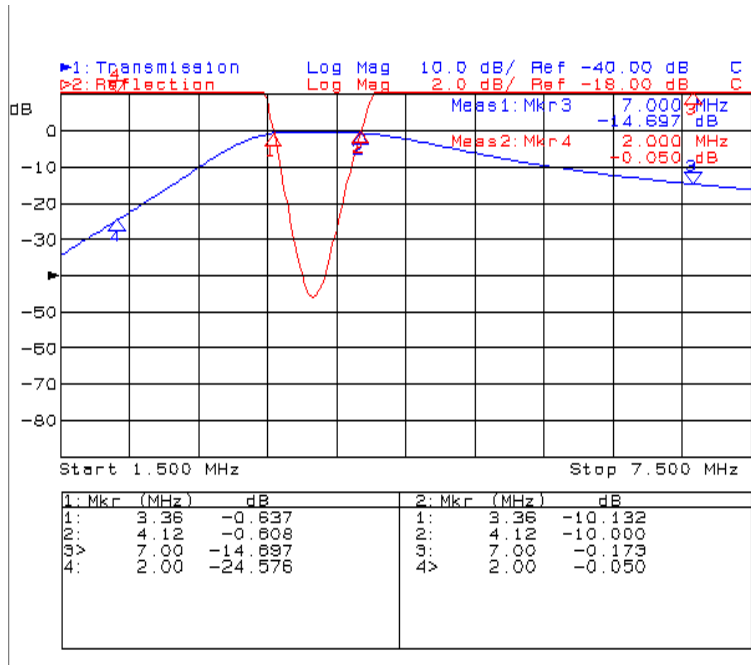
From here on, we decided to measure from the bottom of the next lower band to the top of the next higher band. This required recalibration of the network analyzer for each new frequency range.

Calibration consists of two steps:

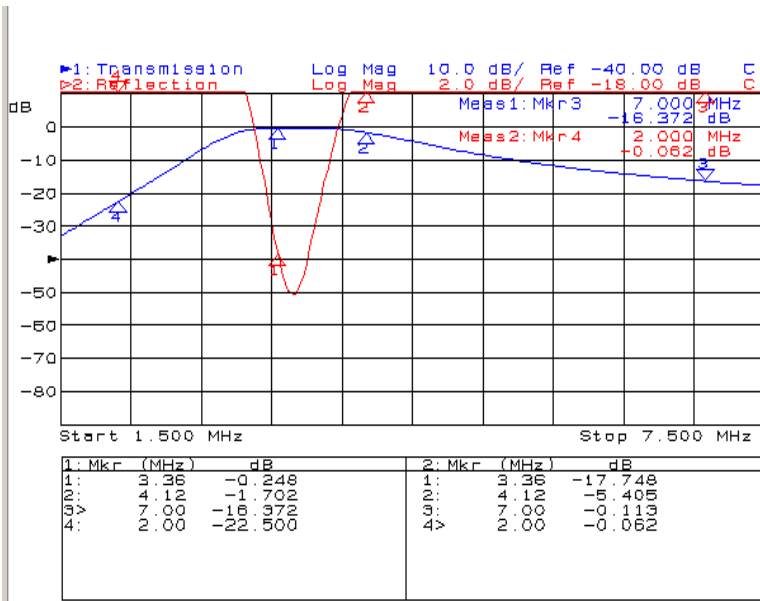
1. Replace the filter under test with a barrel connector. The analyzer measures response, and then stores this. In use, it gets subtracted out from measurements, eliminating concern for the cables between the analyzer and the filters.
2. If measuring return loss (like we did), this is a three phase process: measure an open at the end of the cable, a short, and then a known good load. This allows the analyzer to calculate out the effects of the cable between the analyzer and the filter under test. Return loss at the filter input is what gets displayed.

Moving on to the 80-meter filters:

Measure N3SH80-1

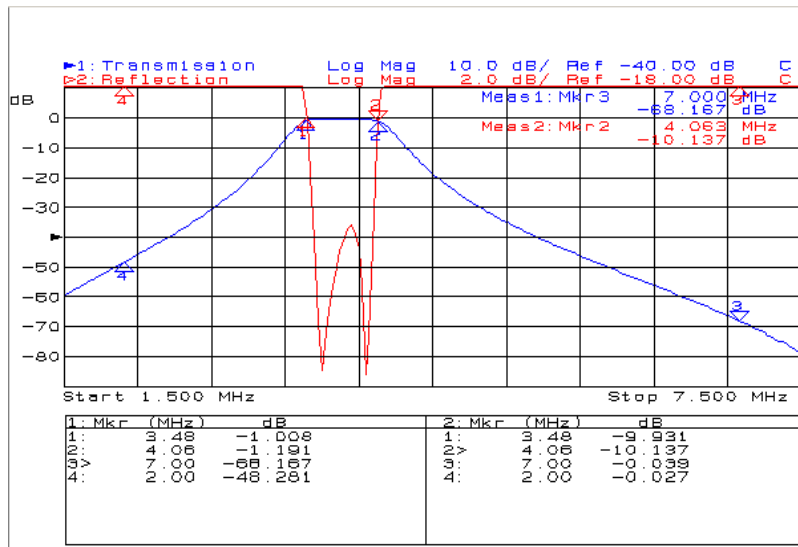


Measure WA3SH80



Pretty much the same, not much defense against 40 meters.

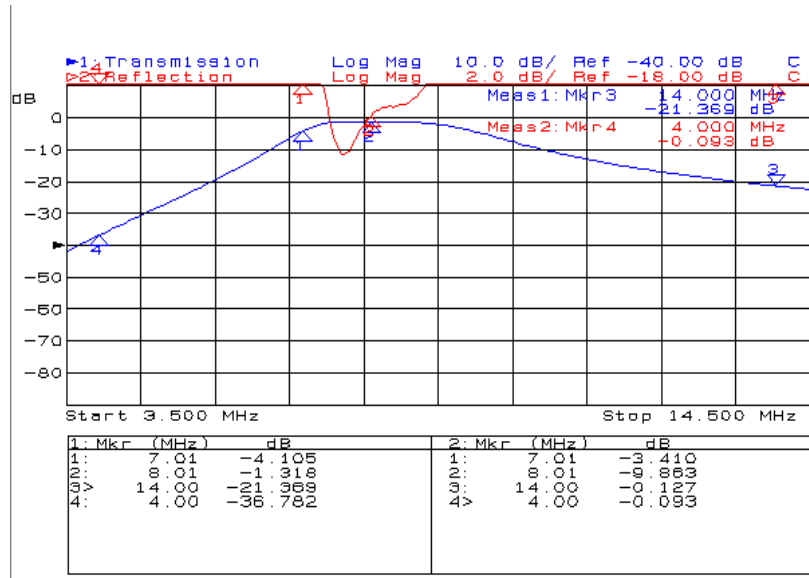
Measure N3SH80-3



This physically larger filter is obviously very different and much better.

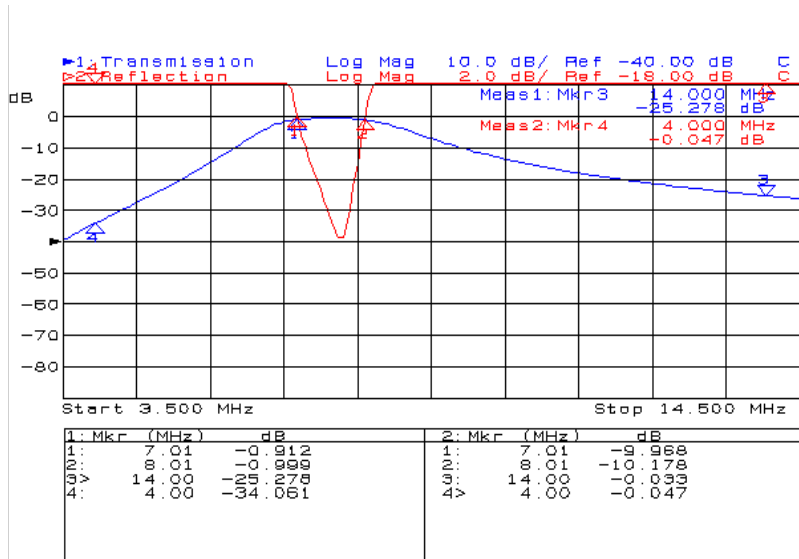
Moving on to 40 meters:

Measure N3SH40-1



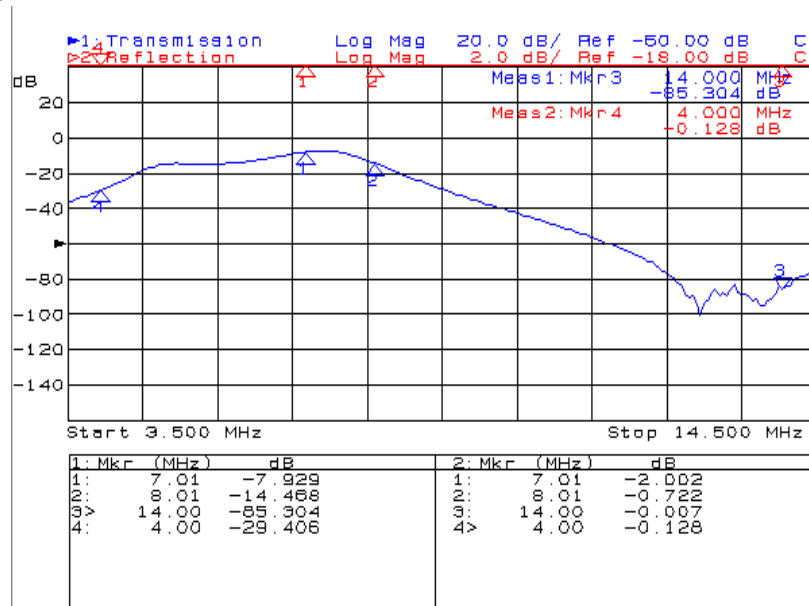
While the passband response looks OK, the return loss indicates that something is wrong. In fact, this is the filter that was taken out of service at Field Day, and when opened up and examined, the input and output capacitors were both exploded.

Measure WA3SH40



This filter shows much better response and return loss and was considered OK.

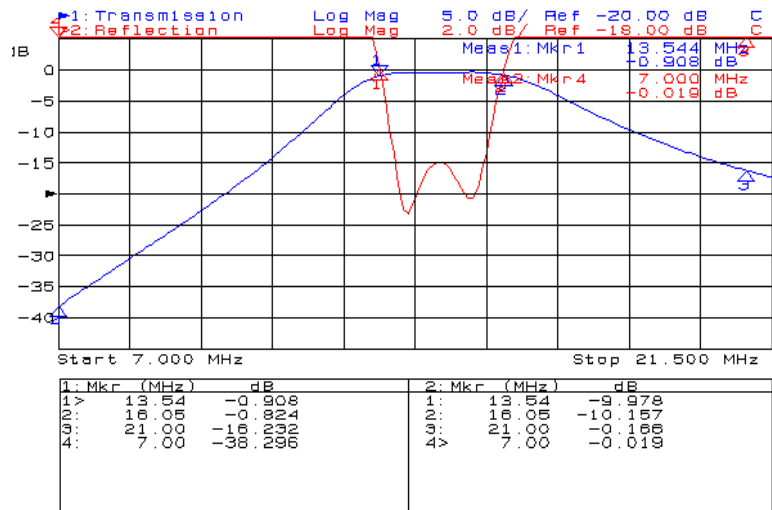
Measure N3SH40-3



This larger filter was expected to perform like N3SH80-3, but is terrible. Obviously something is wrong; when we opened it up, we found evidence of an arc from a winding on a coil the the case. Separating the wire from the case, we measured again – no change. Clearly something is damaged here. Given the \$100+ price, we'd like to think that the manufacturer will repair.

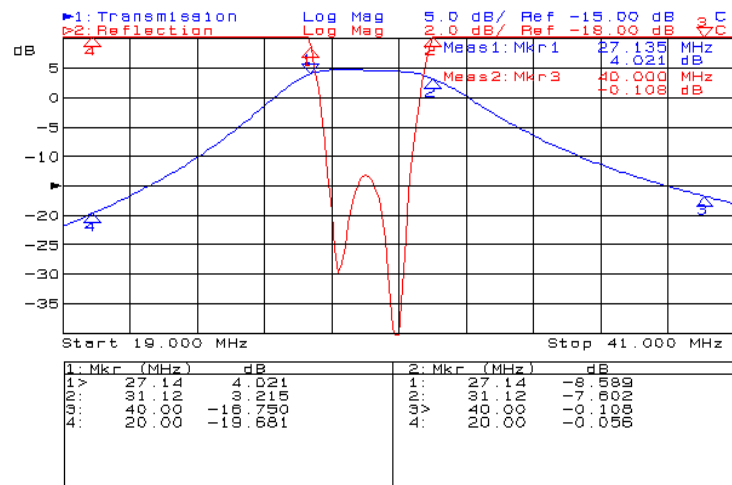
Time to move on to 20 meters:

Measure N3SH20-1



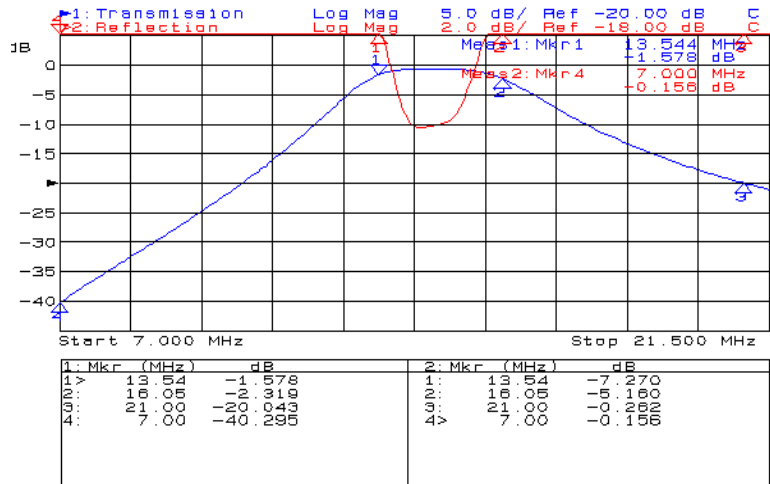
This is nice, note the double-tuned response in return loss. 20 db return loss in the passband is an SWR better than 1.2.

Measure WA3SH20



Also pretty good!

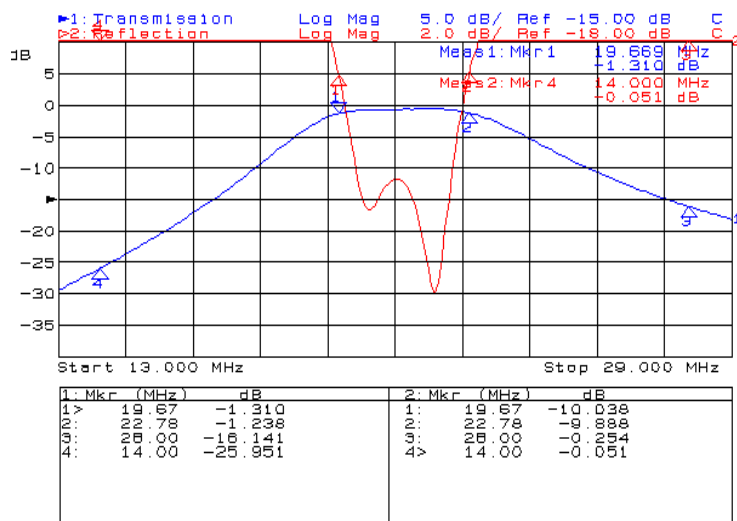
We found another 20m filter, with W3WH written on it. Measuring W3WH20-2



Not quite as good; there may be an issue here as well.

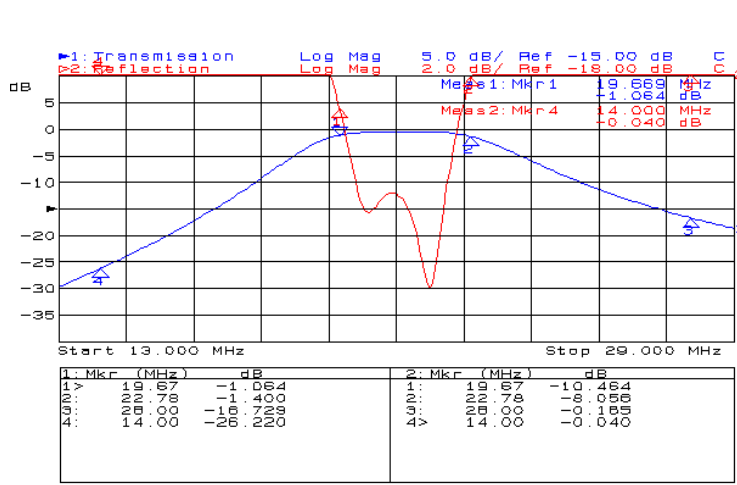
Time to move on to 15 meters:

Measure N3SH15-1



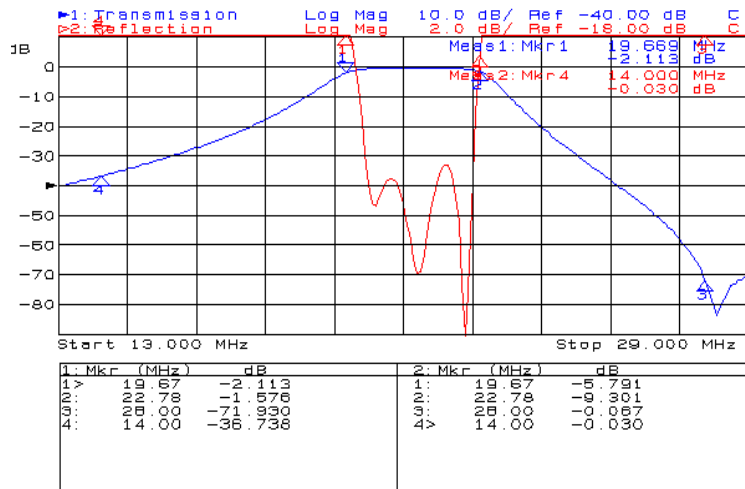
Not bad; assymmetric return loss probably caused by variation in standard component values, without individual unit tuning.

Measure WA3SH15



Also a good filter.

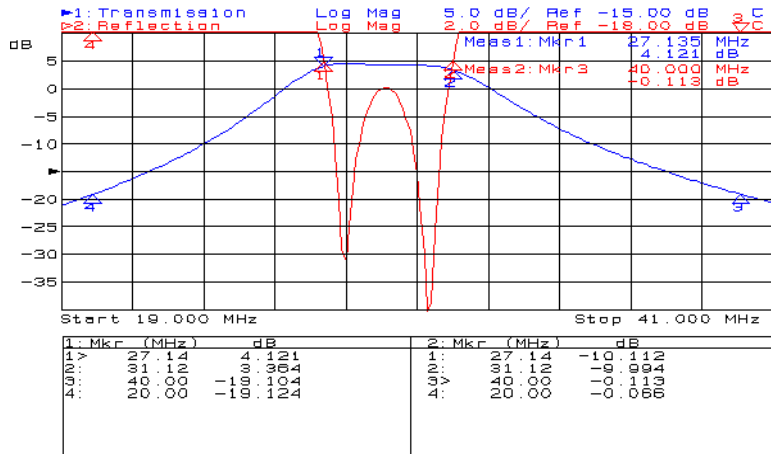
Measure N3SH15-3



Nice!!

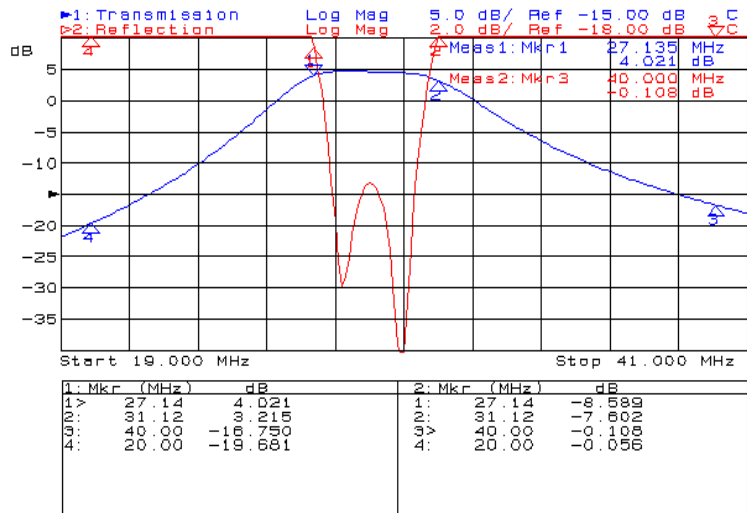
Finally, finish up with 10 meters:

Measure N3SH10-1

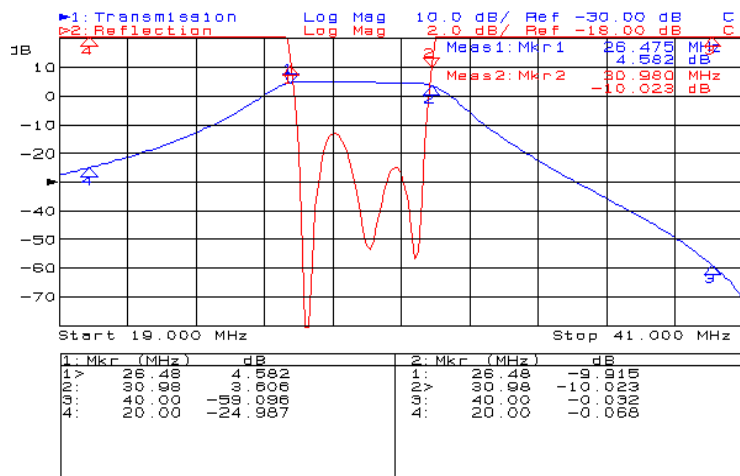


A good filter.

Measure WA3SH10



Finally, measure N3SH10-3



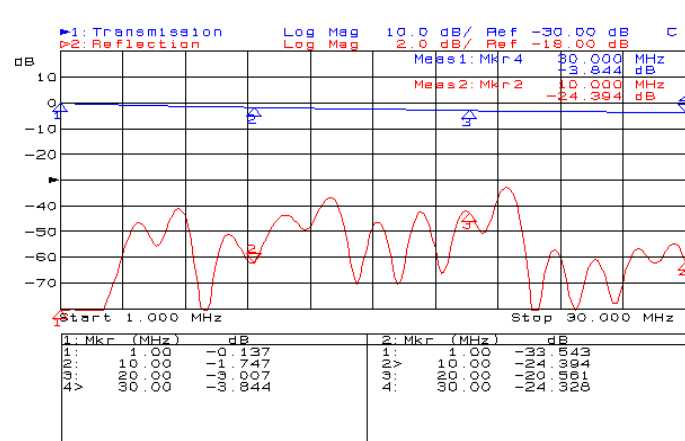
This physically larger filter obviously has more sections, and it shows in the high frequency rolloff. Interesting measurement anomaly, it appears to have gain!

Since we had the network analyzer set up for such measurements, we decided to check out three spools of club cable on hand from Field Day. We measured the response of N3SH coax cables using analyzer transmission measurements, just like the filters.

The network analyzer has a “fault finding” option which we used to measure the length. We told the analyzer that the velocity factor is 0.84 (based on published data for RG-8X) and simulated a fault at the far end with an open circuit. In some cases, we verified the right length by applying a short circuit to the far end, and verified the same distance to the fault.

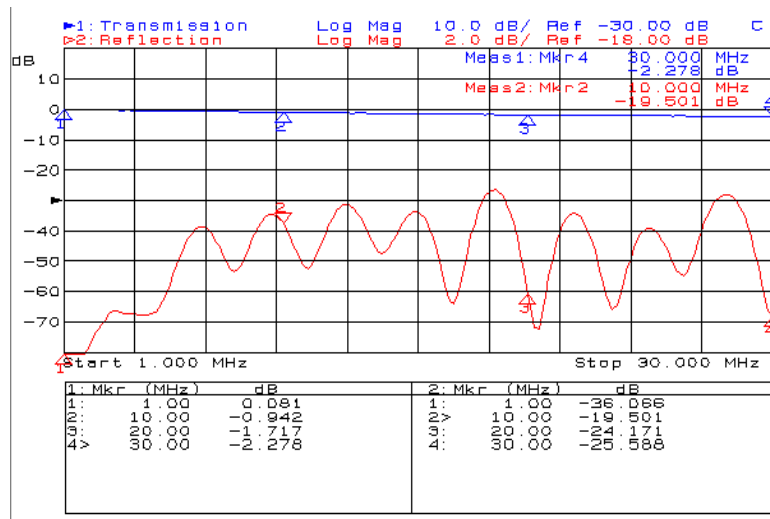
Results:

Cable 1: 210'

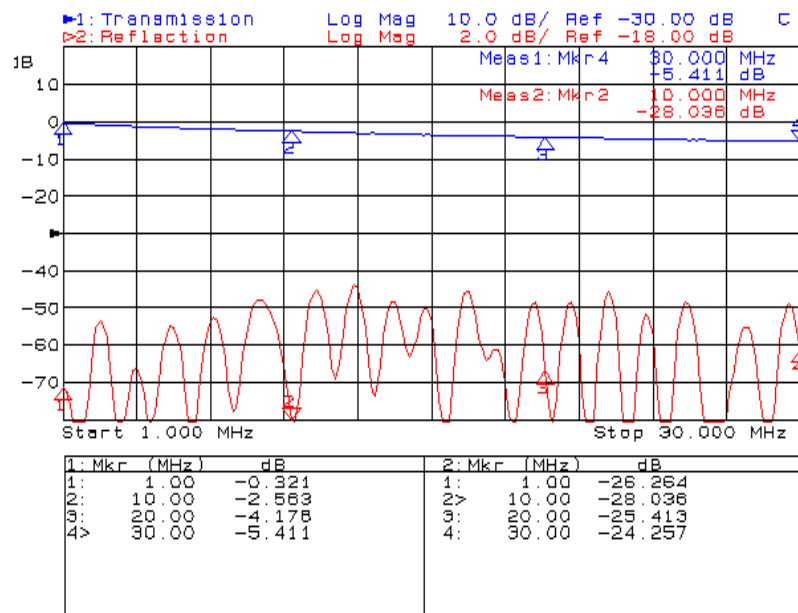


This is considered a good response.

Cable 2: 136'



Cable 3: 294'

**Analysis:**

There are clearly three bad filters. The club coax appears good, although at least one cable showed significant variation when the connectors were touched – those connectors need to be replaced.

Hypothesis:

The defective filters were damaged by a combination of power level and SWR. In at least one case, capacitors are exploded and the coil shows signs of overheating.

Plan:

1. Recommend to club cutting of coax into shorter lengths.
2. Attempt repair of two “small” filters.
3. Obtain repair of damaged “better” filter from OEM.

Results:

Useful data obtained.

Conclusion: